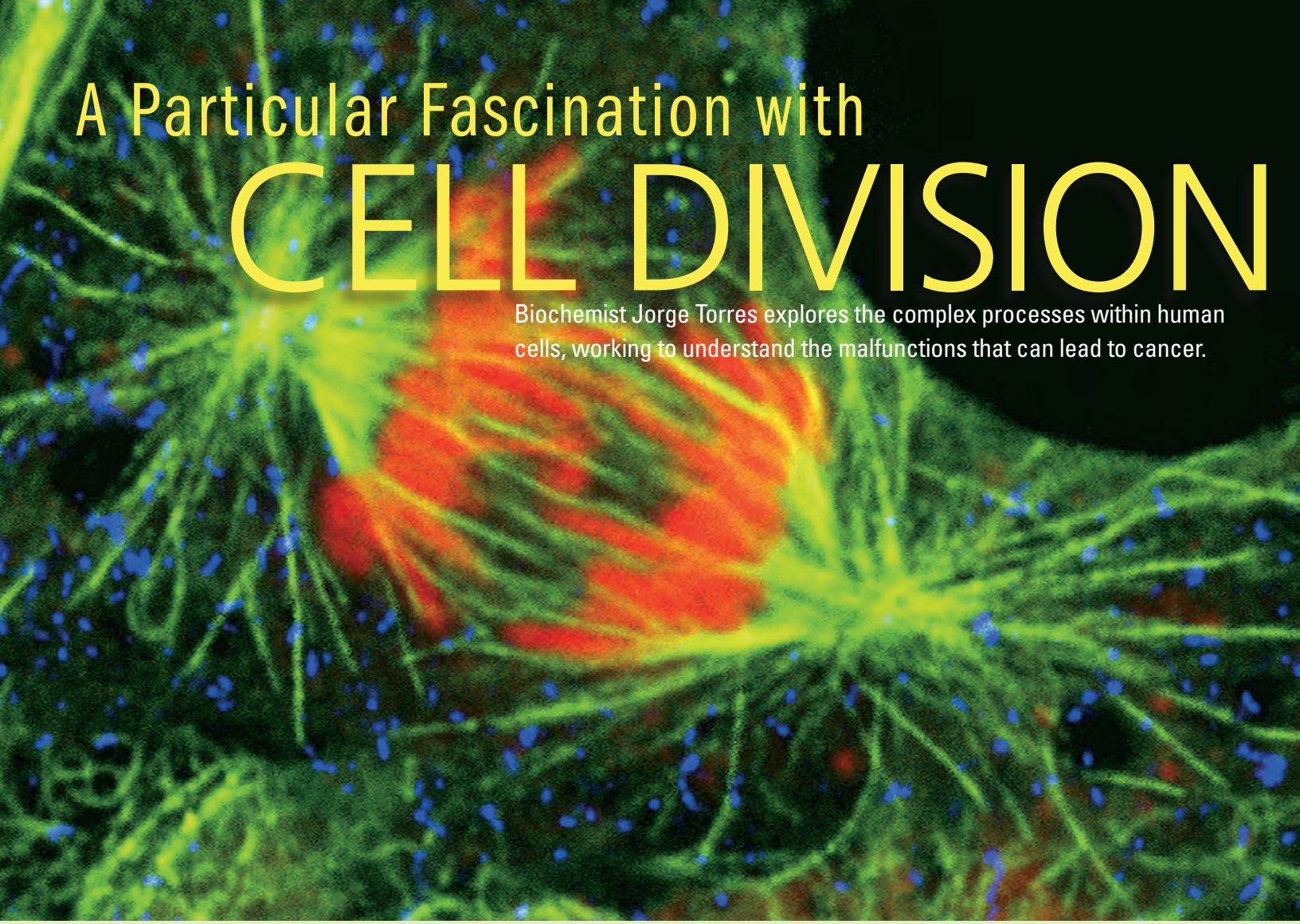

A Particular Fascination with CELL DIVISION

Biochemist Jorge Torres explores the complex processes within human cells, working to understand the malfunctions that can lead to cancer.

"Mapping the key proteins involved in cell division could give us valuable therapeutic vantage points. Once you identify the critical components of cell division, it is then possible to develop therapies that target specific proteins to inhibit cells from dividing. Inhibition of these proteins can have an impact on cancer cells that are proliferating uncontrollably."

By Aaron Dalton

There are probably not too many biochemists who can trace the source of their professional inspiration back to a wrestling coach, but that is where the path began for UCLA assistant professor Jorge Torres. Born in Texas, Torres' family moved to Indio, near Palm Springs; at Indio High School, his wrestling coach was also his biology teacher.

"I really looked up to him as both a mentor and a fantastic teacher," recalls Torres. "He was smart in everything he did, and that is what got me thinking more about pursuing science as a career."

After high school, Torres enrolled at UC Santa Barbara and almost immediately began work in biology labs, studying genomes, chromosomes, and enzymes. One enzyme called telomerase held particular fascination for Torres. When telomerase is activated, it increases the ability of cells to replicate, divide, and almost become immortal. It sounds wonderful on the surface, but the reality is that uncontrolled cell division is one of the defining characteristics of cancer cells. Cancer cells tend to proliferate uncontrollably and form a mass of cells that have the potential to metastasize, enter the bloodstream, and cause havoc throughout the body.

After graduating from UC Santa Barbara, Torres went to Princeton for graduate school, rotating through the labs of several professors and ultimately working to understand the role of certain chromosomal components in cancer prevention.

Torres focused his investigations on enzymes called DNA helicases that play vital roles in both DNA replication and DNA repair. When helicases malfunction, DNA replication stalls and the DNA itself can break into fragments, which leads in turn to chromosomal rearrangements that change the genetic makeup of a cell with potentially dire effects on human health.

By the time he finished his work at Princeton, Torres had decided he wanted to target his research even more specifically on understanding and preventing human diseases. He took a post-doctoral position at the Stanford School of Medicine where he investigated cell mitosis, the crucial step in cell division where chromosomes are separated into two identical sets.

Since joining UCLA in 2009, Torres has continued to investigate mitosis, especially the development of the mitotic spindle. Humans live an average of 80 years, but the lifespans of most of the trillions of cells in a human body are much shorter, measured in days or months. As old cells die out, new ones are born through a continuous process of cell replication and division. Each time a cell divides, it replicates and then must separate its chromosomes. The mitotic spindle is composed of microtubules only nanometers thick that segregate the duplicated chromosomes to opposite poles of the cell so that the cell can divide cleanly down the middle with equal and identical amounts of genetic material ending up in each new cell.

"The mitotic spindle is critical not only to align the chromosomes, but also to pull them apart," said Torres. "The pulling apart has to be equal to both sides, otherwise one cell has too much genetic material and the other side has too little. That can lead to huge problems such as either cell death or uncontrolled cell proliferation."

Torres and the five graduate students and one post-doctoral fellow who work in his lab are studying the enzymes and processes involved in the assembly of the mitotic spindle. Their research on protein interactions may seem abstract, but they hope their findings will be applicable down the road to the development of therapeutic interventions, particularly in the field of oncology.

"Mapping the key proteins involved in the process of cell division could give us valuable therapeutic vantage points," explained Torres. "Once you identify the critical components of cell division, it is then possible to develop therapies that target specific proteins to inhibit cells from dividing. Inhibition of these proteins can have an impact on cancer cells that are proliferating uncontrollably."

Despite having had a good experience working on the 'industry' side of biochemistry when his Stanford laboratory was acquired by biotech firm Genentech, Torres said he always felt drawn toward academia.

"I felt that the university setting offered me freedom to pursue my research interests," he reflected. "Besides, I really enjoy interacting with students, mentoring and teaching them."

Having had such valuable experiences himself as an undergraduate working in a lab, Torres tries to give UCLA undergraduates lots of opportunities to assist with research. He currently has four undergraduates working in his lab.

In the classroom, Torres is teaching a course on post-translational modifications in human diseases, showing his students how incorrect protein modifications can lead to developmental defects or diseases.

"The proteins that modify other proteins are important for practically all pathways within cells," noted Torres. "From signaling and transcript to translation, everything relies on protein modifications."

Beyond his teaching and research, Torres works to give back to the community in other ways. He gives guest lectures at high schools to motivate students to study science. He also gives presentations on campus at UCLA at the invitation of Hispanic student groups.

"There aren't many Hispanic science professors in the United States right now, so to the extent that I can use my experiences to help motivate people to pursue careers in science and medicine, I am more than happy to do that," said Torres.

Although he is still in the early stages of his career, Torres has already received several honors for his scholarship, including UCLA's John McTague Career Development Chair given to promising new faculty and assistant faculty.

"I always knew that I wanted to do science in Southern California, so joining UCLA was definitely a type of homecoming for me," says Torres. "I feel fortunate to have a chance to collaborate with so many great researchers, not just in my department, but also with faculty at the Jonsson Comprehensive Cancer Center, the David Geffen School of Medicine, and the California Nanosystems Institute. Coming here has been fantastic, especially given the extent to which people are willing and eager to collaborate and help each other advance their research."

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